

Customer No.: 31561
Application No.: 10/065,632
Docket No.: 8012-US-PA

REMARKS

Present Status of Patent Application

Claims 15-20 remain pending, of which claim 15 has been amended and claim 18 has been canceled to more clearly describe the claimed invention. Support for amendments to claim 15 can be found on page 5, lines 16-20. It is believed that no new matter adds by way of these amendments made to the claims or otherwise to the application. For at least for the following reasons, Applicant respectfully submits that claims 15-17 and 19-20 patentably define over the prior art of record. Reconsideration is respectfully requested.

Discussion on Claim Rejections:

Response to Claims Rejections under 35 USC§ 103

1. *The Office Action rejected claims 15-17 under 35 U.S.C. 103(a), as being unpatentable over Kwon et al. (US-2002/0017711, hereinafter Kwon) in view of Akram et al. (US2003/0067073, hereinafter Akram).*
2. *The Office Action rejected claims 18-20 under 35 U.S.C. 103(a), as being unpatentable over Kwon and Akram as applied to claims 15-17 above, and in further view of Hwan et al. (US-2002/0180064, hereinafter Hwan).*

In rejecting the above claims, the Office Action stated that Kwon discloses a method of forming a bump of the chip which is similar to the claimed invention except that Kwon fails to teach a step of the bump by an electroless plating method. However, the Office Action relied upon Akram to disclose that the method of electroless plating is

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widely used in the art of making semiconductor and therefore is a conventional process. Therefore, using this method to make the solder bump is recognizable to one of ordinary skill in the art.

Further, the Office Action recognized that both Kwon and Akram fail to disclose a method of forming a photoresist layer having an opening that exposes the bonding pad and removing the photoresist layer. However, the Office Action relied upon Hwan to disclose these steps. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the photoresist as taught by Kwon and Akram's in order to obtain the advantage mention above.

Applicant respectfully disagrees and traverses the above rejections as set forth below. Independent claim 15, as amended, is allowable for at least the reason that Kwon, Akram and Hwan failed to teach, suggest or disclose every features of the claimed invention. More specifically, Kwon, Akram and Hwan failed to teach, suggest or disclose a process of fabricating a bump of a chip comprising at least the steps of "performing an activation step, for depositing a medium layer directly on the bonding pad in the opening of the photoresist layer; and performing an electroless plating process for forming a conductive layer within the opening of the photoresist layer to form at least a bump body directly in contact with the medium layer, as required by the amended claim 15". The advantage of the above process steps is that the process of forming a UBM or a protection layer on passivation layer and the bump pad of the chip can be effectively avoided to substantially simplify the fabrication process of forming the solder bump.

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Therefore the overall cost can be substantially reduced and the throughput can be effectively increased.

The Office Action recognized that Akram discloses an electroless plating method for forming the solder bump, and that both Kwon and Akram fail to disclose a method of forming a photoresist layer having an opening that exposes the bonding pad and removing the photoresist layer. However, the Office Action relied upon Hwan to disclose the use of a photoresist layer for forming the solder bump, and therefore the Office Action is of opinion that it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the photoresist layer of Hwan in Kwon and Akram in order to obtain the advantages mentioned in Hwan.

Applicant respectfully disagrees and would like to point that Akram in page 3, paragraph [0030], merely discloses that a solder bump is directly formed on the UBM by using any known industry technique, such as stenciling, screen printing, electroplating, electroless plating, evaporation, laser ball shooters or the like. Further, Akram in page 2, paragraph [0028], in reference to figures 2a-2d discloses a process including forming a passivation layer (54) on the bump pads (54) of the chip; forming a resist layer (58) on the resist layer; patterning the resist layer and exposing a portion of the passivation layer (56) over the bump pad (54) using the patterned resist as a mask; and removing the resist pattern. Further, Akram in page 3, paragraph [0031], referring figures 4a-4c, illustrate various process steps in the process of forming a solder bump including forming a flash layer (82) on the patterned passivation layer and the bump pad (54); depositing a solder bump (80) on the flash layer (82); and reflowing the solder bump. In other words, Akram substantially fails to disclose, teach or suggest at least [the step of forming a metal layer within the opening of the photoresist layer to form a medium layer directly on the bump pad (54)] as required by the amended claim 15, instead substantially teaches a more complex process of forming a flash layer over the patterned passivation layer and patterning (last two lines of paragraph [0029] on page 3) by standard photolithography techniques. Further, Akram also fails to disclose, teach or suggest the step of performing an electroless plating process by forming a

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conductive layer within the opening of the photoresist layer to form a solder bump directly in contact with the medium layer as required by the amended claim 15, instead substantially teaches Akram merely mentions that the solder bump could be manufactured using an electroless plating process but however fails to disclose a detail process steps to show how the solder bump could be manufactured using an electroplating process. Accordingly, Applicant respectfully submits that Kwon and Akram cannot possibly meet the claimed invention in this regard.

Further, Applicant respectfully submits that Hwan substantially teaches a conventional process of forming a UBM on the chip bump pad and then a conventional process of forming a solder bump on the UBM by using a photoresist layer (34) having a window (38) and filling the window (38) with metal solder.

Applicant would like to point out that a person of ordinary skill in the art is presumed to be one who thinks along the line of conventional wisdom in the art and is not one who undertakes to innovate. Accordingly, the teachings of Kwon, Akram and Hwan would at the best lead one skilled in the art to use the chip having bump pads of Kwon; form a passivation layer 56 as taught by Akram on the surface of the chip; form a UBM layer 108 as taught by Kwon or a UMB layer 26 as taught by Hwan or a flash layer 82 as taught by Akram by performing complex known techniques such as CVD and patterning by standard photolithography process; form a patterned photoresist layer (34) over the resulting structure as taught by Hwan; and form a solder bump in the opening of the photoresist (34) of Hwan by performing an electroless plating process. In other words, the best possible process in the light of the teachings of Kwon, Akram and Hwan still requires at least the following addition process steps. Namely, at least one CVD process for depositing a flash layer 82 of Akram, and at least a standard photolithography process including a photomask, a photoresist layer, patterning of the photoresist layer and then patterning the flash layer 82. In other words, the combined teachings of Kwon, Akram and Hwan cannot possibly teach, suggest or hint a step of forming a conductive layer in the opening of the photoresist layer to form a medium layer directly on the bump pad.

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Applicant would like to point out that the novelty is not merely to show a step of forming a conductive layer in the opening of the photoresist layer to form a medium layer directly on the bump pad but rather to show how to simplify the process of forming the solder bump by significantly reducing the number of complex process steps such as avoiding the steps of forming a standard UBM layer before forming the solder bump. Accordingly, the overall fabrication cost can be reduced and the throughput can also be significantly increased.

Further, on page 3 of the Office Action, the Examiner stated that in regard to claim 16, Kwon further discloses that the bump is made of nickel (see section [0023]). Applicant respectfully disagrees with the interpretation of section [0023] of Kwon. Kwong fails to disclose that the bump is made of nickel in [0023], instead, kwong substantially discloses that the UBM 108 is a multi-layered and includes nickel, copper, gold, titanium, chromium, titanium-tungsten and or nickel-vanadium layers (please see [0023] lines 4-7). Accordingly, Kwong cannot meet claim 16 in this regard.

For at least the foregoing reasons, Applicant respectfully submits claims 15-17 and 19-20 patently define over **Kwon, Akram and Hwan**, and therefore should be allowed. Reconsideration and withdrawal of these rejections is respectfully requested.

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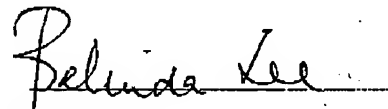
CONCLUSION

For at least the foregoing reasons, it is believed that all pending claims 15-17 and 19-20 are in proper condition for allowance. If the Examiner believes that a conference would be of value in expediting the prosecution of this application, he is cordially invited to telephone the undersigned counsel to arrange for such a conference.

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Respectfully submitted


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